

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1 1. (Currently amended) A method for logging file system operations,
2 comprising:
 - 3 receiving a request to perform a file system operation;
 - 4 making a call to an underlying file system to perform the file system
5 operation; and
 - 6 logging the file system operation to a log within a log device to facilitate
7 recovery of the file system operation in the event of a system failure before the file
8 system operation is committed to non-volatile storage;
 - 9 wherein the file system operation includes arguments and data needed to
 - 10 repeat the file system operation;
 - 11 wherein the request to perform the file system operation is received at a
12 primary server in a highly available system;
 - 13 wherein the log device is located on a secondary server that is separate
14 from the primary server in the highly available system and that acts as a backup
15 for the primary server; and
 - 16 wherein locating the log on the secondary server facilitates failover to the
17 secondary server when the primary server fails.
 - 1 2. (Original) The method of claim 1, wherein logging the file system
2 operation involves storing an identifier for the file system operation to the log
3 device.

1 3. (Original) The method of claim 1, further comprising periodically
2 committing the log to the underlying file system by:
3 freezing ongoing activity on a file system;
4 making a call to the underlying file system to flush memory buffers to non-
5 volatile storage, whereby outstanding file system operations are guaranteed to be
6 committed to non-volatile storage;
7 removing outstanding file system operations from the log; and
8 unfreezing the ongoing activity on the file system.

1 4. (Original) The method of claim 1, wherein upon a subsequent computer
2 system startup, the method further comprises:
3 examining the log within the log device;
4 replaying any file system operations from the log that have not been
5 committed to non-volatile storage.

1 5. (Original) The method of claim 1, further comprising checking for
2 dependencies between the file system operation and ongoing file system
3 operations; and
4 if dependencies are detected, ensuring that the file system operation and
5 the ongoing file system operations complete in an order that satisfies the
6 dependencies.

1 6 (Canceled).

1 7. (Original) The method of claim 1, further comprising:
2 associating the file system operation with a transaction identifier for a set
3 of related file system operations; and

4 wherein logging the file system operation involves storing the file system
5 operation with the transaction identifier to the log device.

1 8. (Original) The method of claim 1, wherein logging the file system
2 operation involves:

3 determining if the file system operation belongs to a subset of file system
4 operations that are subject to logging; and
5 if so, logging the file system operation.

1 9. (Original) The method of claim 8, wherein the subset of file system
2 operations are non-idempotent file system operations.

1 10. (Original) The method of claim 1, wherein the log device stores the
2 file system operation in volatile storage.

1 11. (Original) The method of claim 1, wherein the log device stores the
2 file system operation in non-volatile storage.

1 12. (Currently amended) A computer-readable storage medium storing
2 instructions that when executed by a computer cause the computer to perform a
3 method for logging file system operations, the method comprising:
4 receiving a request to perform a file system operation;
5 making a call to an underlying file system to perform the file system
6 operation; and
7 logging the file system operation to a log within a log device to facilitate
8 recovery of the file system operation in the event of a system failure before the file
9 system operation is committed to non-volatile storage;

10 wherein the file system operation includes arguments and data needed to
11 repeat the file system operation;

12 wherein the request to perform the file system operation is received at a
13 primary server in a highly available system;

14 wherein the log device is located on a secondary server that is separate
15 from the primary server in the highly available system and that acts as a backup
16 for the primary server; and

17 wherein locating the log on the secondary server facilitates failover to the
18 secondary server when the primary server fails.

1 13. (Original) The computer-readable storage medium of claim 12,
2 wherein logging the file system operation involves storing an identifier for the file
3 system operation to the log device.

1 14. (Original) The computer-readable storage medium of claim 12,
2 wherein the method further comprises periodically committing the log to the
3 underlying file system by:

4 freezing ongoing activity on a file system;

5 making a call to the underlying file system to flush memory buffers to non-
6 volatile storage, whereby outstanding file system operations are guaranteed to be
7 committed to non-volatile storage;

8 removing outstanding file system operations from the log; and

9 unfreezing the ongoing activity on the file system.

1 15. (Original) The computer-readable storage medium of claim 12,
2 wherein upon a subsequent computer system startup, the method further
3 comprises:

4 examining the log within the log device;

5 replaying any file system operations from the log that have not been
6 committed to non-volatile storage.

1 16. (Original) The computer-readable storage medium of claim 12,
2 wherein the method further comprises checking for dependencies between the file
3 system operation and ongoing file system operations; and
4 if dependencies are detected, ensuring that the file system operation and
5 the ongoing file system operations complete in an order that satisfies the
6 dependencies.

1 17 (Canceled).

1 18. (Original) The computer-readable storage medium of claim 12,
2 wherein the method further comprises:
3 associating the file system operation with a transaction identifier for a set
4 of related file system operations; and
5 wherein logging the file system operation involves storing the file system
6 operation with the transaction identifier to the log device.

1 19. (Original) The computer-readable storage medium of claim 12,
2 wherein logging the file system operation involves:
3 determining if the file system operation belongs to a subset of file system
4 operations that are subject to logging; and
5 if so, logging the file system operation.

1 20. (Original) The computer-readable storage medium of claim 19,
2 wherein the subset of file system operations are non-idempotent file system
3 operations.

1 21. (Original) The computer-readable storage medium of claim 12,
2 wherein the log device stores the file system operation in volatile storage.

1 22. (Original) The computer-readable storage medium of claim 12,
2 wherein the log device stores the file system operation in non-volatile storage.

1 23. (Currently amended) An apparatus that logs file system operations,
2 comprising:
3 a receiving mechanism that is configured to receive a request to perform a
4 file system operation;
5 a calling mechanism that is configured to make a call to an underlying file
6 system to perform the file system operation; and
7 a logging mechanism that is configured to log the file system operation to
8 a log within a log device to facilitate recovery of the file system operation in the
9 event of a system failure before the file system operation is committed to non-
10 volatile storage;

11 wherein the file system operation includes arguments and data needed to
12 repeat the file system operation;

13 wherein the receiving mechanism is located within a primary server in a
14 highly available system;

15 wherein the log device is located within a secondary server that is separate
16 from the primary server in the highly available system and acts as a backup for the
17 primary server; and

18 wherein locating the log on the secondary server facilitates failover to the
19 secondary server when the primary server fails.

1 24. (Original) The apparatus of claim 23, wherein the logging mechanism
2 is configured to store an identifier for the file system operation to the log device.

1 25. (Original) The apparatus of claim 23, wherein the logging mechanism
2 is configured to periodically:

3 freeze ongoing activity on a file system;
4 make a call to the underlying file system to flush memory buffers to non-
5 volatile storage, whereby outstanding file system operations are guaranteed to be
6 committed to non-volatile storage;
7 remove outstanding file system operations from the log; and to
8 unfreeze the ongoing activity on the file system.

1 26. (Original) The apparatus of claim 23, further comprising a recovery
2 mechanism that operates during system startup, wherein the recovery mechanism
3 is configured to:

4 examine the log within the log device; and to
5 replay any file system operations from the log that have not been
6 committed to non-volatile storage.

1 27. (Original) The apparatus of claim 23, further comprising a dependency
2 handler that is configured to:

3 check for dependencies between the file system operation and ongoing file
4 system operations; and to
5 ensure that the file system operation and the ongoing file system
6 operations complete in an order that satisfies dependencies if dependencies are
7 detected.

1 28 (Canceled).

1 29. (Original) The apparatus of claim 23, further comprising a transaction
2 mechanism that is configured to associate the file system operation with a
3 transaction identifier for a set of related file system operations; and
4 wherein the logging mechanism is configured to log the file system
5 operation with the transaction identifier to the log device.

1 30. (Original) The apparatus of claim 23, wherein the logging mechanism
2 is configured to:
3 determine if the file system operation belongs to a subset of file system
4 operations that are subject to logging; and to
5 log the file system operation if the file system operation belongs to the
6 subset of file system operations that are subject to logging.

1 31. (Original) The apparatus of claim 30, wherein the subset of file system
2 operations are non-idempotent file system operations.

1 32. (Original) The apparatus of claim 23, wherein the log device is
2 configured to store the file system operation in volatile storage.

1 33. (Original) The apparatus of claim 23, wherein the log device is
2 configured to store the file system operation in non-volatile storage.